

TEST REPORT

Product Name : Camera Hub G5 Pro (Wi-Fi)
Model Number : CH-C07E, CH-C07D

Prepared for : Lumi United Technology Co., Ltd.
Address : Room 801-804, Building 1, Chongwen Park, Nanshan
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Taoyuan Residential District, Nanshan District, Shenzhen,
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Modified Information

Version	Report No.	Revision Date	Summary
	ENS2411080085W02304R	/	Original Report



1. TEST RESULT CERTIFICATION

Applicant : Lumi United Technology Co., Ltd.
 Address : Room 801-804, Building 1, Chongwen Park, Nanshan iPark, No. 3370, Liuxian Avenue, Fuguang Community, Taoyuan Residential District, Nanshan District, Shenzhen, China
 Manufacturer : Lumi United Technology Co., Ltd.
 Address : Room 801-804, Building 1, Chongwen Park, Nanshan iPark, No. 3370, Liuxian Avenue, Fuguang Community, Taoyuan Residential District, Nanshan District, Shenzhen, China
 EUT : Camera Hub G5 Pro (Wi-Fi)
 Model Name : CH-C07E, CH-C07D
 Trademark : Aqara

Measurement Procedure Used:

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
ETSI EN 300 440 v2.2.1: 2018	PASS
AS/NZS 4268: 2017 Amd 1:2021	PASS

The device described above is tested by EMTEK (Shenzhen) Co., Ltd. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and EMTEK (Shenzhen) Co., Ltd. is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the above table standards requirement.

This report applies to above tested sample only and shall not be reproduced in part without written approval of EMTEK (Shenzhen) Co., Ltd.

Date of Test : November 12, 2024 to November 20, 2024

Prepared by : 
Una Yu/Editor

Reviewer : 
Joe Xia/Supervisor

Approved & Authorized Signer : 
Lisa Wang/Manager

2.EUT DESCRIPTION

Product:	Camera Hub G5 Pro (Wi-Fi)
Model Number:	CH-C07E, CH-C07D
Device Type:	WIFI 5G with 5725MHz-5850MHz Band
WLAN Supported:	802.11a 802.11n(20MHz channel bandwidth) 802.11n(40MHz channel bandwidth) 802.11ac(20MHz channel bandwidth) 802.11ac(40MHz channel bandwidth) 802.11ac(80MHz channel bandwidth)
Frequency Range:	WIFI 5G with 5725MHz-5850MHz Band: 5745-5825MHz for 802.11a 5745-5825MHz for 802.11n(HT20) 5755-5795MHz for 802.11n(HT40) 5745-5825MHz for 802.11ac(HT20) 5755-5795MHz for 802.11ac(HT40) 5775MHz for 802.11ac(HT80)
Modulation:	OFDM
Smart System:	SISO
Antenna Type:	FPC Antenna
Antenna Gain:	0.5 dBi
Power Supply:	5V 2A
Temperature Range:	-30~+50°C

Note: for more details, please refer to the user's manual of the EUT.

3. SUMMARY OF TEST RESULT

Transmitters conformance requirements			
Clause (EN 300 440)	Test Parameter	Verdict	Remark
4.2.2	Equivalent isotropically radiated power (e.i.r.p.)	PASS	Applies to all devices with transmitters
4.2.3	Permitted range of operating frequencies	PASS	Applies to all devices with transmitters
4.2.4	Unwanted emissions in the spurious domain	PASS	Applies to all devices with transmitters
4.2.5	Duty cycle	N/A	Transmitting devices which do not use LBT, DAA, or RFID transmitters operating in the 2 446 to 2 454 MHz band transmitting more than 500 mW e.i.r.p. power level
4.2.6	Additional requirements for FHSS equipment	N/A	Equipment utilizing FHSS modulation
Receivers conformance requirements			
Clause (EN 300 440)	Test Parameter	Verdict	Remark
4.3.3	Adjacent channel selectivity	N/A	Applies to equipment Category 1 receivers
4.3.4	Blocking or desensitization	PASS	Applies to category 1, 2, and 3 SRD communication media receivers
4.3.5	Spurious radiations	PASS	Applies to all receivers, except receivers used in combination with permanently colocated transmitters continuously transmitting
Note: N/A is an abbreviation for not applicable.			

4. TEST METHODOLOGY

4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards: ETSI EN 300 440 –Short Range Devices (SRD); Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

4.2 MEASUREMENT EQUIPMENT USED

For Spurious Emissions Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Pre-Amplifier	Bonn	BLMA 011001N	2213967A	2023/10/23	1Year
EMI Test Receiver	Rohde & Schwarz	ESR7	102551	2023/10/23	1Year
Bilog Antenna	Schwarzbeck	VULB9163	9163142	2024/7/8	2Year
Horn antenna	Schwarzbeck	BBHA9120D	9120D-1198	2023/6/2	2Year
Pre-Amplifier	Bonn	BLMA 0118-5G	2213967B-01	2023/10/23	1Year
Spectrum Analyzer	Rohde & Schwarz	FSV3044	101290	2023/10/23	1Year
Horn antenna	Schwarzbeck	BBHA9170	9170-399	2023/5/12	2Year
Pre-Amplifier	Lunar EM	LNA18G26-40	J1012131010 001	2024/5/11	1Year
Pre-Amplifier	Lunar EM	LNA26G40-40	J1013131028 001	2024/5/11	1Year
Loop Antenna	Schwarzbeck	FMZB1519	1519-012	2023/5/12	2Year

For Other Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Wideband Radio Communication Tester	R&S	CMW500	171168	2024/9/18	1Year
Frequency Extender	R&S	CMW-Z800A	100430	2024/9/18	1Year
Analog Signal Generator	R&S	SMB100A	183237	2024/9/18	1Year
Vector Signal Generator	R&S	SMM100A	101808	2024/9/18	1Year
RF Control Unit(Power Meter)	Tonscend	JS0806-2	22C8060567	2024/9/18	1Year
Temperature&Humidity Chamber	ESPEC	EL-02KA	12107166	2024/5/10	1 Year

4.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

The EUT has been tested under its typical operating condition. so those modulation and channel were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

WIFI 5G with 5725MHz-5850MHz

Frequency and Channels list for 802.11a/n(20)/ac(20)/ax(20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	157	5785	165	5825
153	5765	161	5805		

Frequency and Channels list for 802.11n(40)/ac(40)/ax(40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
151	5755				
159	5795				

Frequency and Channels list for 802.11ac(80)/ax(80):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
155	5775				

Test Frequency and Channels for 802.11a/n(20)/ac(20)/ax(20):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	157	5785	165	5825

Test Frequency and channels for 802.11n(40)/ac(40)/ax(40):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
151	5755			159	5795

Test Frequency and channels for 8802.11ac(80)/ax(80):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
155	5775				

5.FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at Bldg 69, Majialong Industry Zone District, Nanshan District, Shenzhen, China. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5.3 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description

Name of Firm

: EMTEK (SHENZHEN) CO., LTD.

Site Location

: Building 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China

6. TEST SYSTEM UNCERTAINTY

Maximum measurement uncertainty of the test system

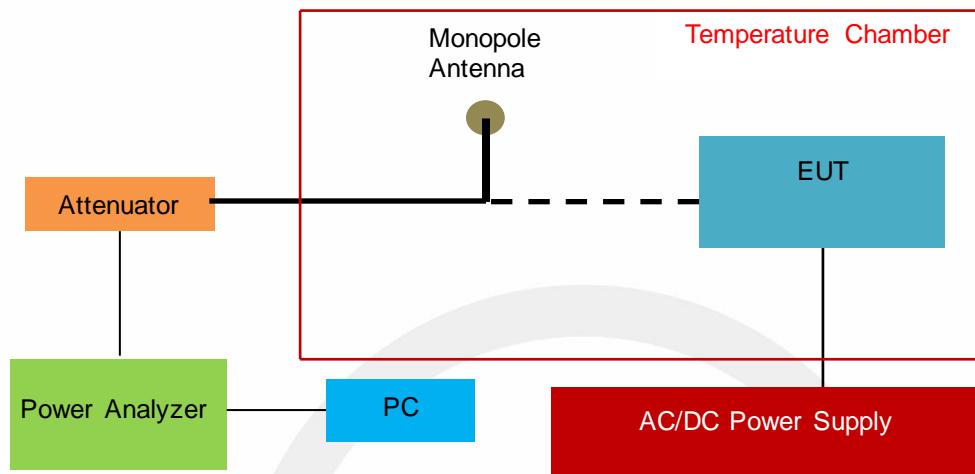
Test Parameter	Measurement Uncertainty
Radio Frequency	$\pm 1 \times 10^{-7}$
RF Power (Conducted)	$\pm 2,5$ dB
Radiated Emission of Transmitter,	± 6 dB
Radiated Emission of Receiver,	± 6 dB
Temperature	± 1 °C
Humidity	± 5 %



7.SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

Conducted measurements configuration of EUT shall be as follows:

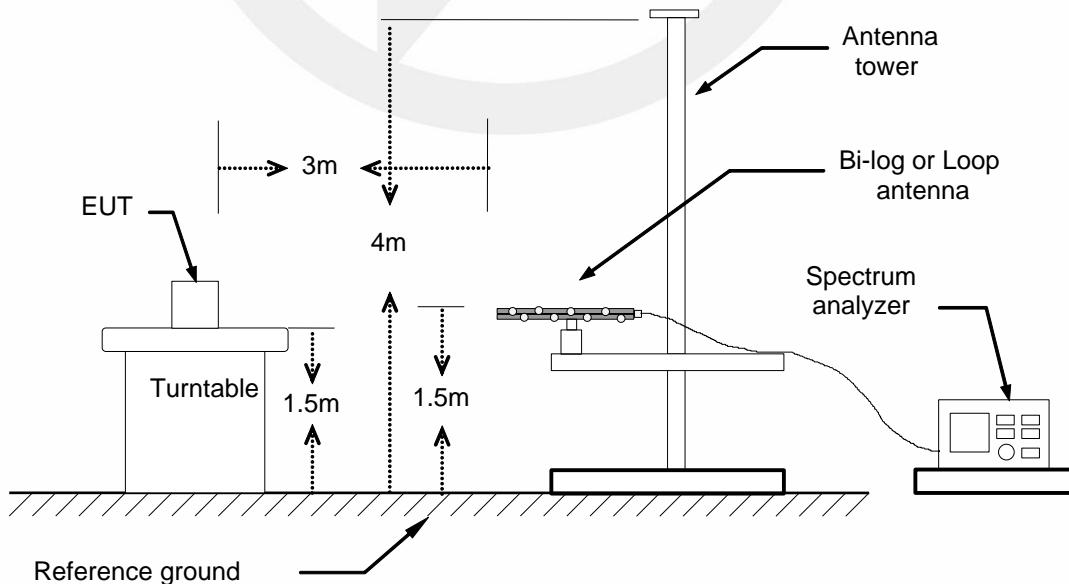


Remarks:

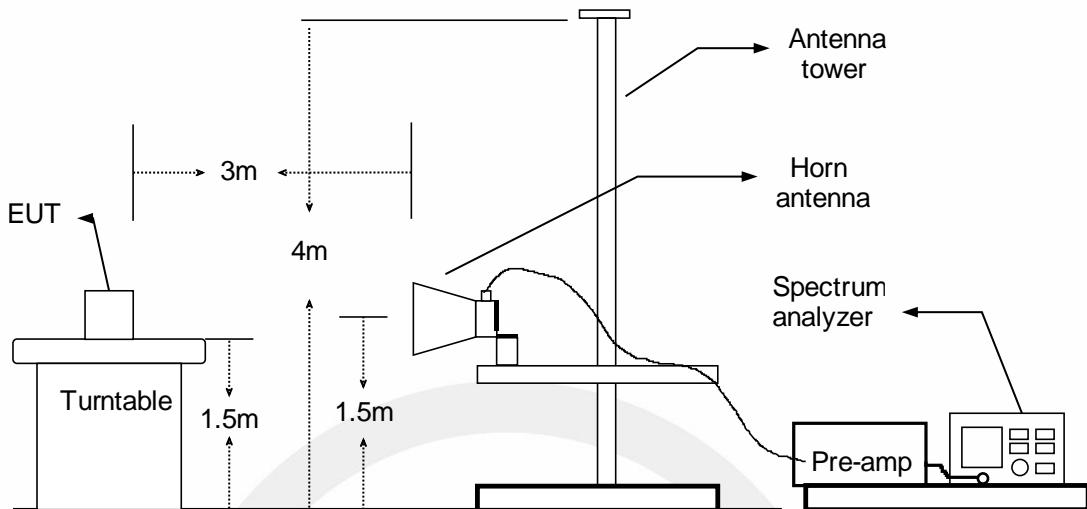
The Signal Analyzer could be connected to a monopole antenna or directly connected to the EUT, if the EUT has already employing an antenna connector.

Radiated measurements configuration of EUT shall be as follows:

Below 1GHz



Above 1GHz



7.2 SUPPORT EQUIPMENT

N/A

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

8.TRANSMITTER REQUIREMENTS

8.1 EQUIVALENT ISOTROPICALLY RADIATED POWER (E.I.R.P.)

8.1.1 Applicable standard

EN 300 440 Clause 4.2.2

8.1.2 Conformance Limit

Maximum radiated peak power (e.i.r.p.)

Frequency Bands	Power	Application	Notes
2400 MHz to 2483.5 MHz	10 mW e.i.r.p.	Non-specific short range devices	
5725 MHz to 5875 MHz	25 mW e.i.r.p.	Non-specific short range devices	

8.1.3 Test Configuration

The measurements for equivalent isotropically radiated power shall be performed at both normal environmental conditions and at the extremes of the operating temperature range.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.

Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s)

8.1.4 Test Procedure

1. Please refer to ETSI EN 300 440 (V2.2.1) clause 5 for the test conditions.
2. Please refer to ETSI EN 300 440 (V2.2.1) clause 4.2.2.3 for the measurement method.

■ General requirements

To measure e.i.r.p. it is first necessary to determine the appropriate method of measurement: see clauses 4.2.2.3.1 and 4.2.2.3.2. The -6 dB transmitter bandwidth shall be determined using a 100 kHz measuring bandwidth in order to establish which measurement method is applicable:

- clause 4.2.2.3.1 for Non spread spectrum transmitters with a -6 dB bandwidth of up to 20 MHz and spread spectrum transmitters with channel bandwidth of up to 1 MHz;
- clause 4.2.2.3.2 for all other transmitter bandwidths.

Using the applicable measurement procedure as described in clause 4.2.2.3.2 and annex B, the power output shall be measured and recorded in the test report. The method of measurement shall be documented in the test report.

Measurements shall be performed at normal test conditions (see clause 5.6).

Where possible, the equipment shall be able to operate in a continuous transmit mode for testing purposes.

- Non spread spectrum transmitters with a -6 dB bandwidth of up to 20 MHz and spread spectrum transmitters with channel bandwidth of up to 1 MHz

● General

The method of measurement in clauses 4.2.2.3.1.1 or 4.2.2.3.1.2 shall only be used for:

- non spread spectrum equipment with a -6 dB bandwidth of 20 MHz or less and a duty cycle above 50 %;
- spread spectrum equipment with a -6 dB channel bandwidth of 1 MHz or less.

For peak power measurements, a spectrum analyser or frequency-selective voltmeter shall be used and tuned to the transmitter carrier at which the highest level is detected.

For FHSS systems, the hop frequency which provides the maximum indicated level shall be used. The frequency shall be indicated in the test report.

Other transmitters are tested according to clause 4.2.2.3.2.

- Equipment measured as constant envelope modulation equipment

For practical reasons, measurements shall be performed only at the highest power level at which the transmitter is intended to operate.

The measurement shall be performed preferably in the absence of modulation.

When it is not possible to measure it in the absence of modulation, this fact shall be stated in test reports. The transmitter shall be set in continuous transmission mode. If this is not possible, the measurements shall be carried out in a period shorter than the duration of the transmitted burst. It may be necessary to extend the duration of the burst.

The transmitter shall be connected to an artificial antenna (see clause 5.8.2) and the power delivered to this artificial antenna shall be measured.

The equivalent isotropically radiated power is then calculated from the measured value, the known antenna gain, relative to an isotropic antenna, and if applicable, any losses due to cables and connectors in the measurement system.

● Equipment measured as non-constant envelope modulation equipment

The measurement shall be performed with test signals D-M2 or D-M3 as appropriate.

The transmitter shall be preferably set in continuous transmission mode. If this is not possible, the measurement can be performed in discontinuous mode.

The transmitter shall be connected to an artificial antenna (see clause 5.8.2) and the power delivered to this artificial antenna shall be measured. The measuring instrument shall have a measurement bandwidth not less than sixteen times the channel bandwidth.

The equivalent isotropically radiated power is then calculated from the measured value, the known antenna gain, relative to an isotropic antenna, and if applicable, any losses due to cables and connectors in the measurement system.

■ Transmitters other than those defined in clause 4.2.2.3.1

This method of measurement shall be used for:

a) equipment with a -6 dB bandwidth greater than 20 MHz, and equipment with a duty cycle below 50 %; or for

b) spread spectrum equipment with a channel bandwidth above 1 MHz.

The equivalent isotropically radiated power shall be determined and recorded.

In case of radiated measurements on smart antenna systems using symmetrical power distribution across the available transmit chains, the EUT should, where possible, be configured so that only one transmit chain (antenna) is activated while the other transmit chains are disabled. Where this is not possible, the method used shall be documented in the test report. If only one transmit chain was tested, the result for the active transmit chain shall be corrected to be valid for the whole system (all transmit chains).

NOTE: The power (in mW) for one transmit chain needs to be multiplied with the number of transmit chains to obtain the total power for the system.

The measurement shall be performed using normal operation of the equipment with the test modulation applied (see clause 5.8.1).

The test procedure shall be as follows:

Step 1:

- using a suitable means, the output of the transmitter shall be coupled to a matched diode detector;
- the output of the diode detector shall be connected to the vertical channel of an oscilloscope;
- the combination of the diode detector and the oscilloscope shall be capable of faithfully reproducing the envelope peaks and the duty cycle of the transmitter output signal;
- the observed duty cycle of the transmitter (Tx on/(Tx on + Tx off)) shall be noted as x, ($0 < x < 1$) and recorded.

Step 2:

- the average output power of the transmitter shall be determined using a wideband, calibrated RF power meter with a matched thermocouple detector or an equivalent thereof and, where applicable, with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "A" (in dBm);
- the e.i.r.p. shall be calculated from the above measured power output A, the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:
$$- P = A + G + 10 \log(1/x);$$

- P shall not exceed the value specified in clause 4.2.2.4.

The measurement shall be repeated at the lowest, the middle, and the highest frequency of the stated frequency range.

These frequencies shall be recorded. FHSS equipment shall be made to hop continuously to each of these three frequencies separately.

8.1.5 Test Results

All the modulation modes were tested, the data of the worst mode are described in the table.

Test Condition	Test Mode	Antenna	Frequency [MHz]	TP C	Set Power	Conducted power [dBm]	Duty Cycle [%]	DC Factor [dBm]	Result [dBm]	Gain [dB Bi]	EIR P [dB m]	EIR P Limit [dB m]	Verdict
NTNV	11A	Ant1	5745	NA	NA	11.15	93.18	0.31	11.46	0.50	11.96	13.98	PASS
NTNV	11A	Ant1	5785	NA	NA	11.75	93.21	0.31	12.06	0.50	12.56	13.98	PASS
NTNV	11A	Ant1	5825	NA	NA	11.98	97.63	0.10	12.08	0.50	12.58	13.98	PASS
NTNV	11N20 SISO	Ant1	5745	NA	NA	10.98	97.45	0.11	11.09	0.50	11.59	13.98	PASS
NTNV	11N20 SISO	Ant1	5785	NA	NA	11.37	95.98	0.18	11.55	0.50	12.05	13.98	PASS
NTNV	11N20 SISO	Ant1	5825	NA	NA	11.81	91.39	0.39	12.20	0.50	12.70	13.98	PASS
NTNV	11N40 SISO	Ant1	5755	NA	NA	11.23	87.85	0.56	11.79	0.50	12.29	13.98	PASS
NTNV	11N40 SISO	Ant1	5795	NA	NA	11.62	91.26	0.40	12.02	0.50	12.52	13.98	PASS
NTNV	11AC 20SISO	Ant1	5745	NA	NA	10.96	91.87	0.37	11.33	0.50	11.83	13.98	PASS
NTNV	11AC 20SISO	Ant1	5785	NA	NA	11.41	97.46	0.11	11.52	0.50	12.02	13.98	PASS
NTNV	11AC 20SISO	Ant1	5825	NA	NA	11.82	93.24	0.30	12.12	0.50	12.62	13.98	PASS
NTNV	11AC 40SISO	Ant1	5755	NA	NA	11.20	86.36	0.64	11.84	0.50	12.34	13.98	PASS
NTNV	11AC 40SISO	Ant1	5795	NA	NA	11.59	90.48	0.43	12.02	0.50	12.52	13.98	PASS
NTNV	11AC 80SISO	Ant1	5775	NA	NA	11.01	76.27	1.18	12.19	0.50	12.69	13.98	PASS

8.2 PERMITTED RANGE OF OPERATING FREQUENCIES

8.2.1 Applicable standard

According to ETSI EN 300 440 clause 4.2.3

8.2.2 Conformance Limit

According to ETSI EN 300 440 clause 4.2.2.4

8.2.3 Test Configuration

The measurements for permitted range of operating frequencies shall under both normal and extreme operating conditions.

Except for the occupied bandwidth assessment for which measurement at normal operating conditions is sufficient.

8.2.4 Test Procedure

1. Please refer to ETSI EN 300 440 (V2.2.1) clause 5 for the test conditions.

2. Please refer to ETSI EN 300 440 (V2.2.1) clause 4.2.3.3 for the measurement method.

■ Description

The permitted range of operating frequencies includes all frequencies on which the equipment may operate within an assigned frequency band. The operating frequency range shall be declared by the manufacturer.

The frequency range of the equipment is determined by the lowest and highest frequencies occupied by the power envelope in accordance with clause 4.2.2.4, table 2.

FH is the highest frequency of the power envelope, it is the frequency furthest above the frequency of maximum power where the output power envelope drops below the level of -75 dBm/Hz spectral power density (e.g. -30 dBm if measured in a 30 kHz reference bandwidth) e.i.r.p.

FL is the lowest frequency of the power envelope; it is the frequency furthest below the frequency of maximum power where the output power drops below the level of -75 dBm/Hz spectral power density (e.g. -30 dBm if measured in a 30 kHz reference bandwidth) e.i.r.p.

The occupied bandwidths and OCW of the transmitter shall be declared. Where differing modes of emission are available, all modes and their associated bandwidths shall be stated.

The range of frequencies, determined by clause 4.2.3, shall be specified in the test report.

■ Method of measurement

The method of measurement for equipment employing FHSS and stepped frequency modulation is given in clause 4.2.3.4.

Using applicable conducted measurement procedures, as described in annex C, the frequency range(s) shall be measured and recorded in the test report.

Where applicable, during these measurements the test data sequence as specified in clauses 5.8.1 and 5.8.1.1 shall be used. The transmitter power level shall be set to the rated power level.

These measurements shall be performed under both normal and extreme operating conditions except for the occupied bandwidth assessment for which measurement at normal operating conditions is sufficient.

The measurement procedure shall be as follows:

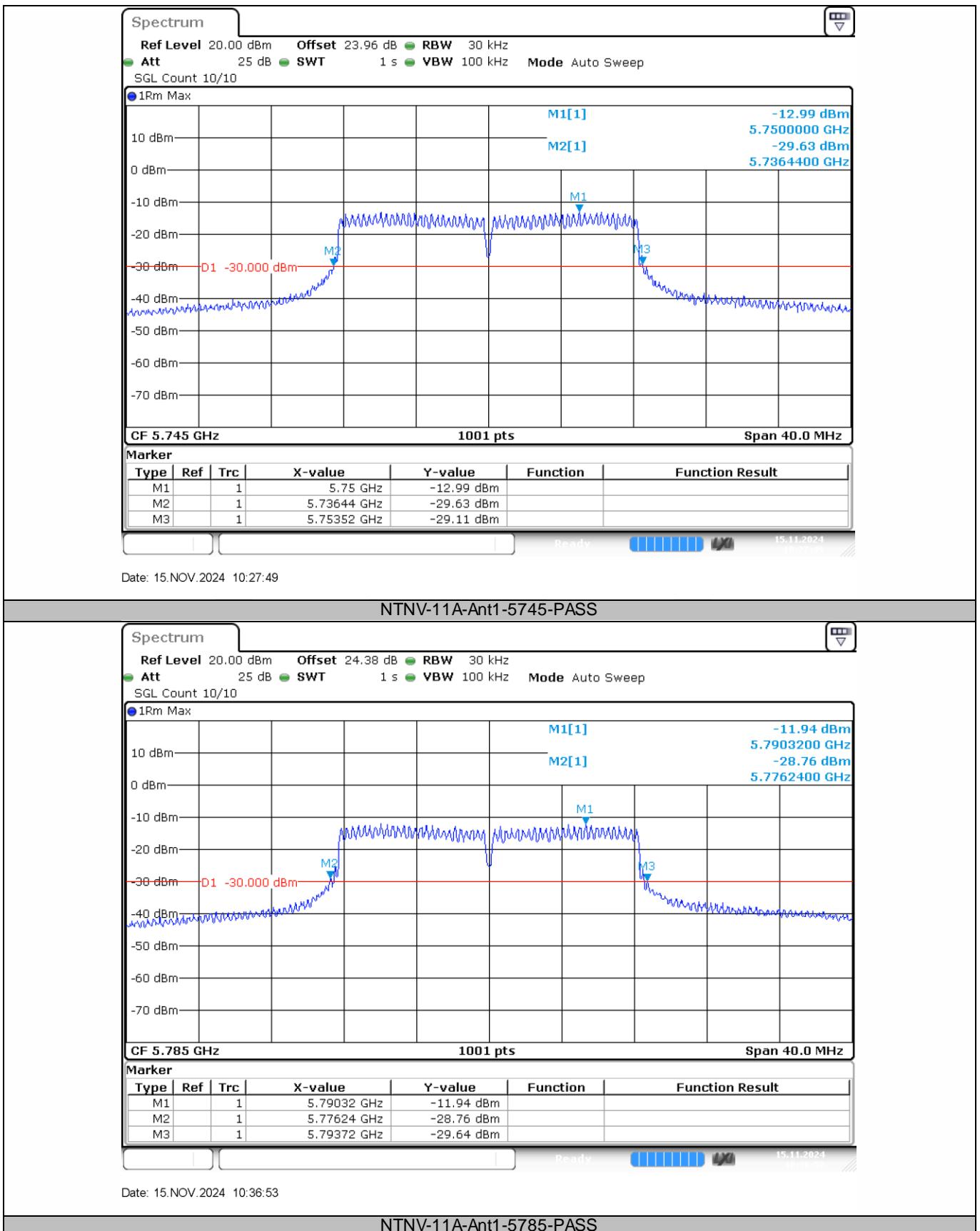
- a) put the spectrum analyser in video averaging mode with a minimum of 50 sweeps selected;
- b) select the lowest operating frequency of the equipment under test and activate the transmitter with modulation applied. The RF emission of the equipment shall be displayed on the spectrum analyser;
- c) using the marker of the spectrum analyser, find the lowest frequency below the operating frequency at which the spectral power density drops below the level given in clause 4.2.3. This frequency shall be recorded in the test report;
- d) select the highest operating frequency of the equipment under test and find the highest frequency at which the spectral power density drops below the value given in clause 4.2.3. This frequency shall be recorded in the test report;
- e) the difference between the frequencies measured in steps c) and d) is the operating frequency range. It shall be recorded in the test report.

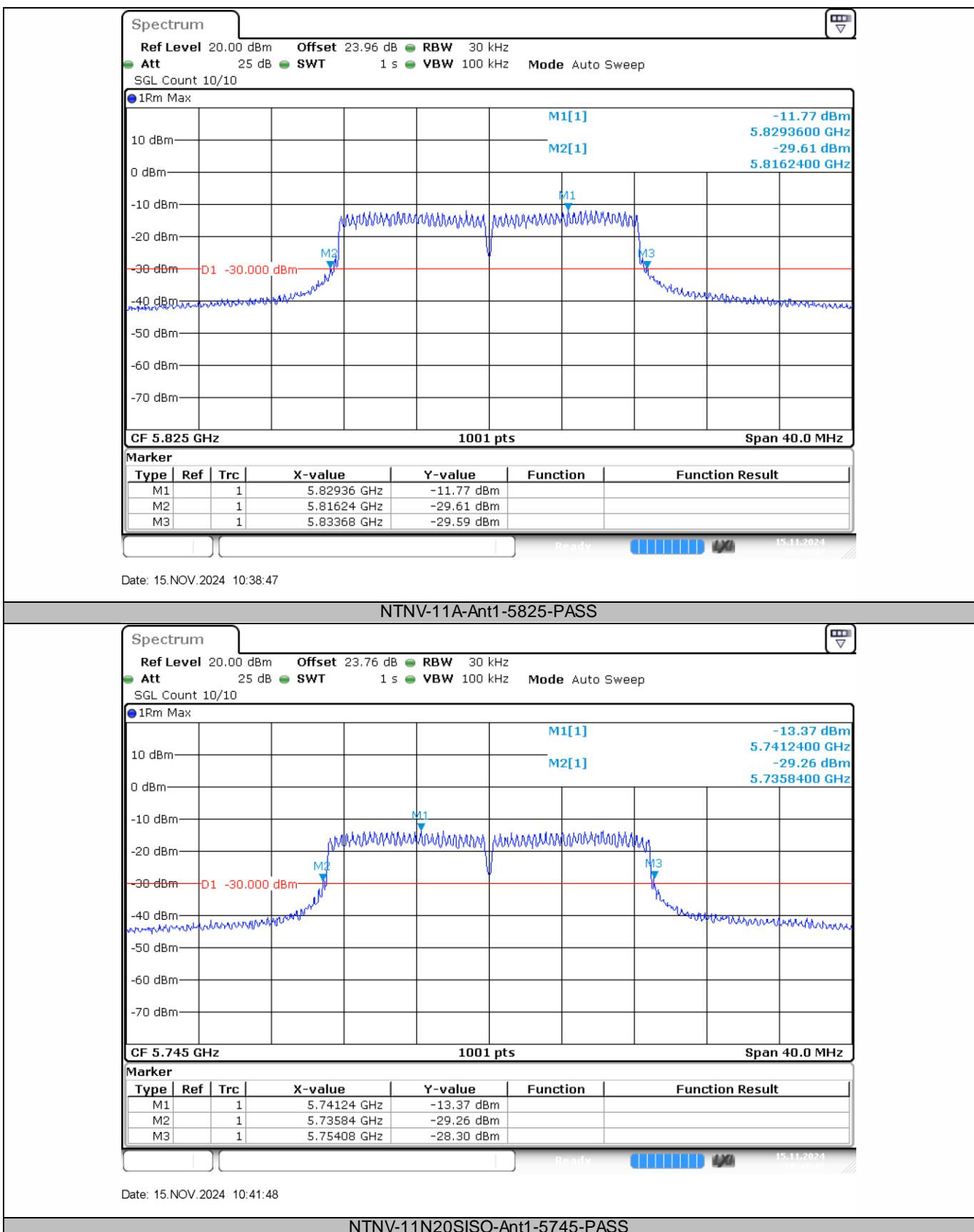
This measurement shall be repeated for each frequency range declared by the manufacturer.

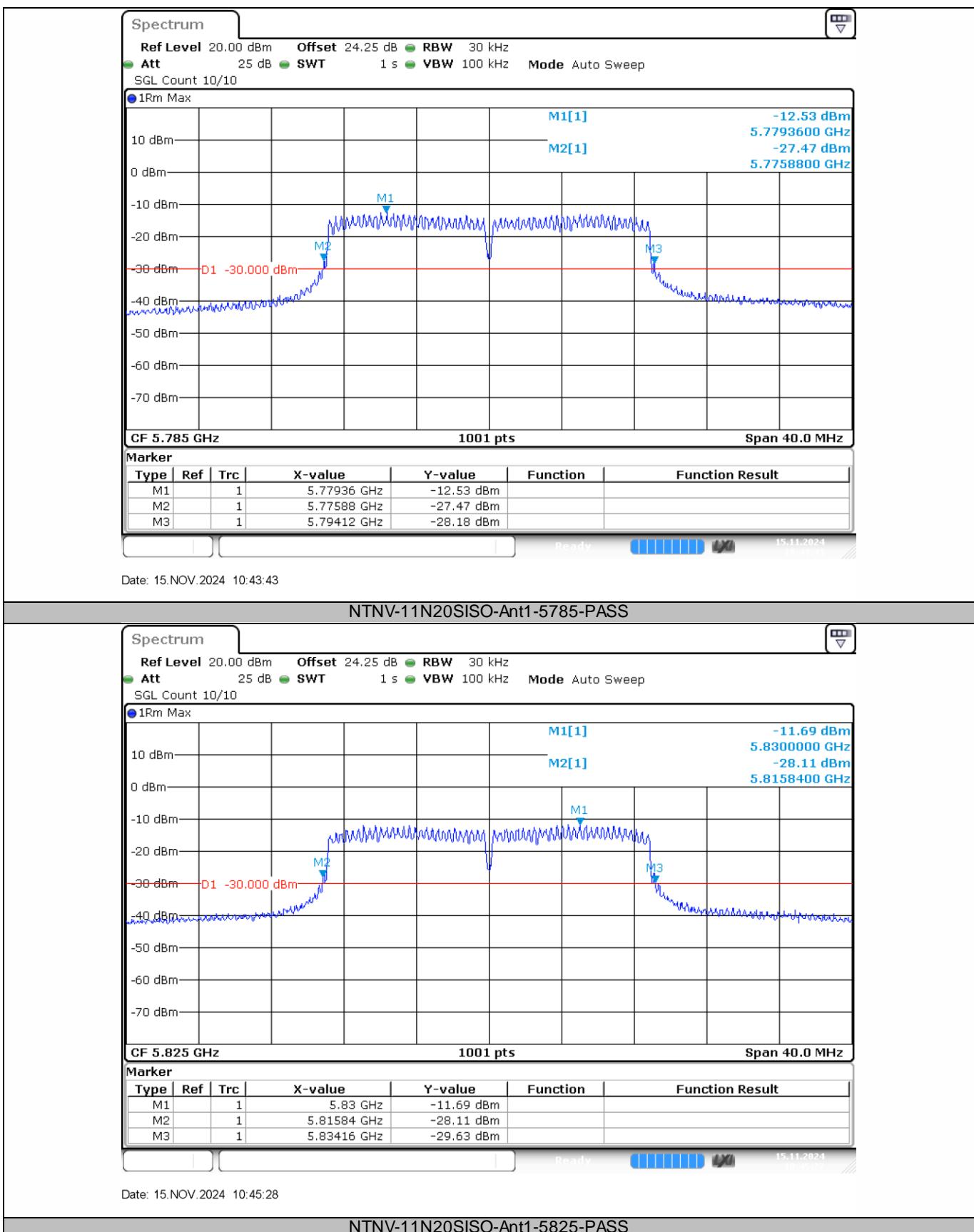
8.2.5 Test Results

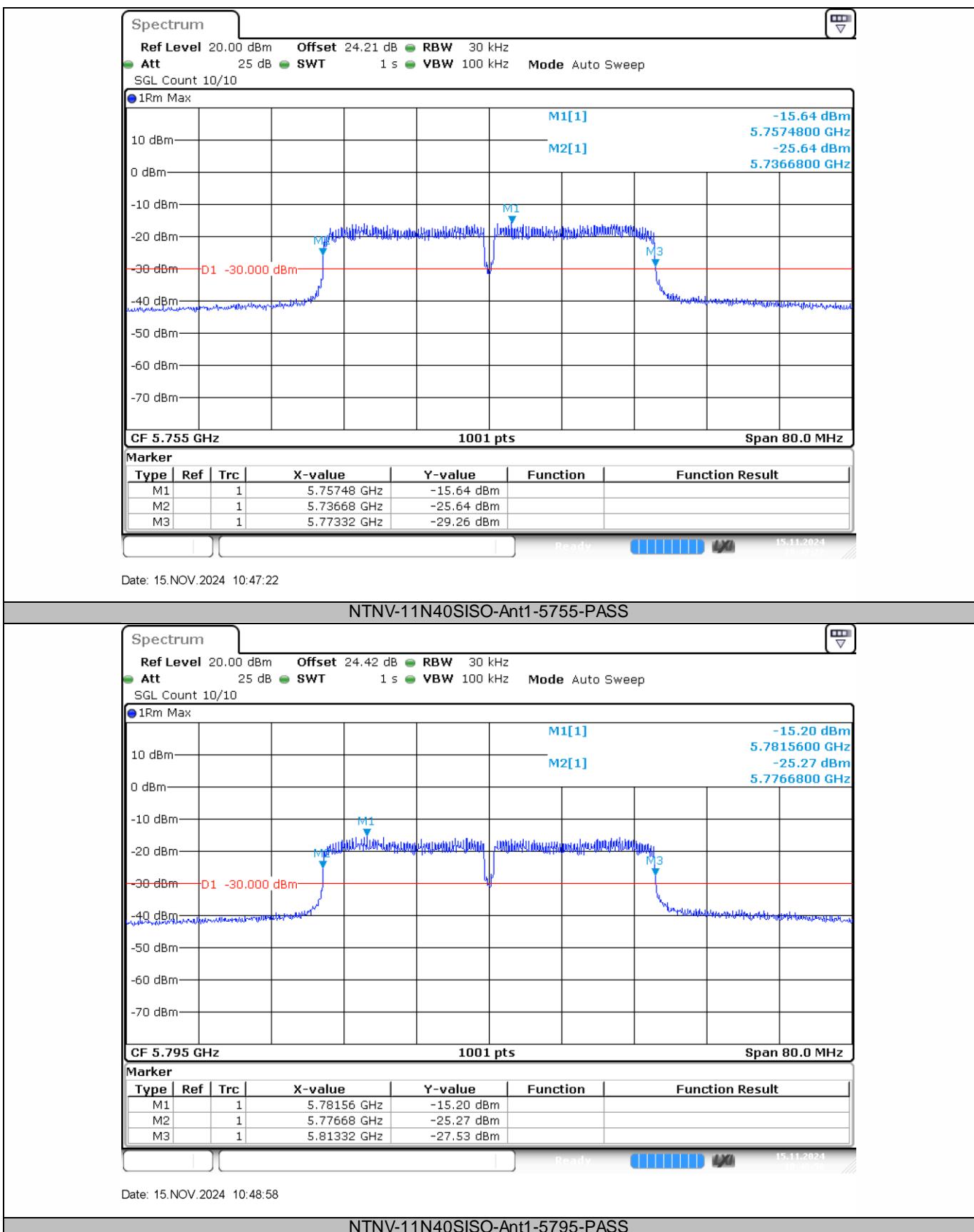
All the modulation modes were tested, the data of the worst mode are described in the following table.

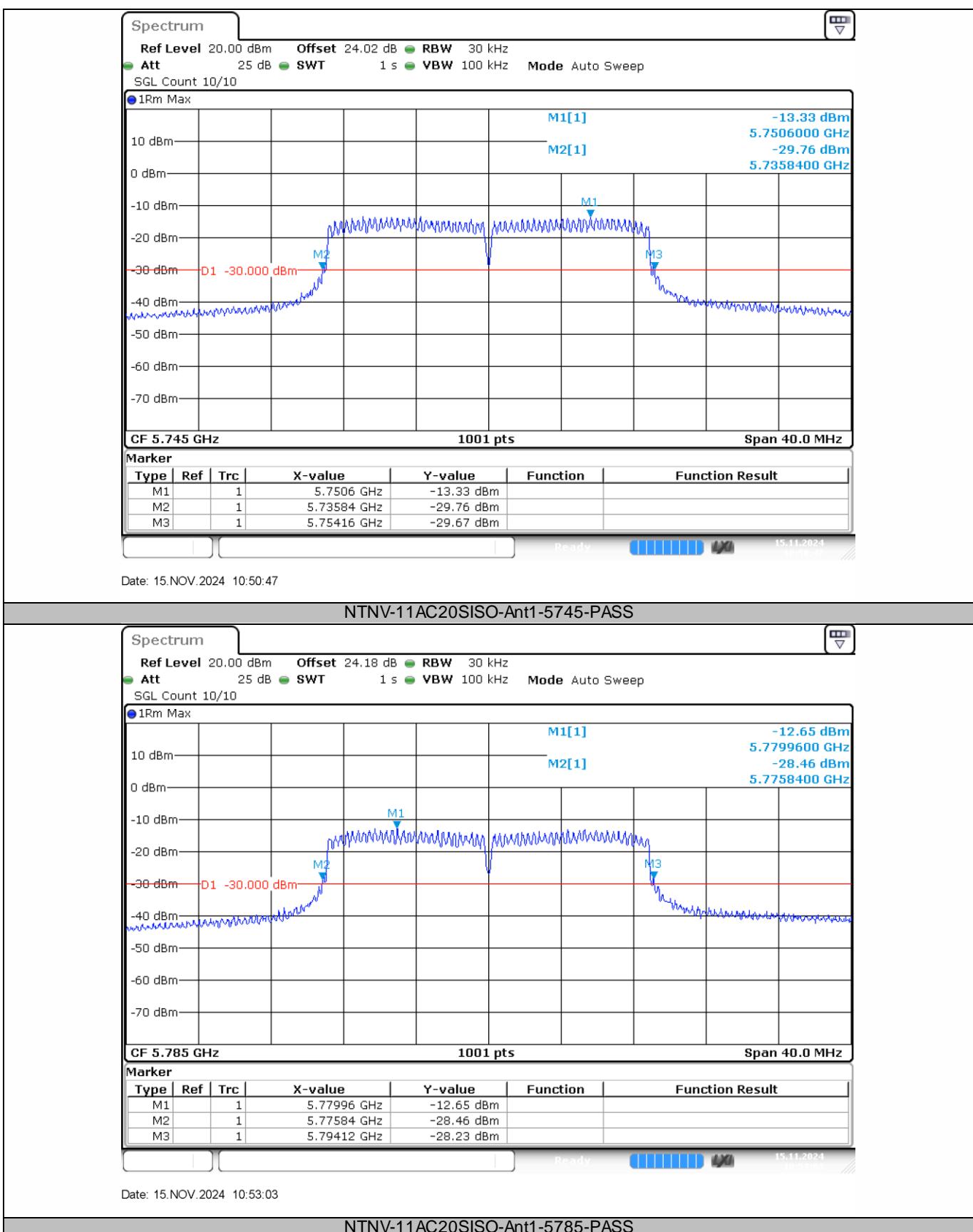
TestCondition	TestMode	Antenna	Frequency[MHz]	FL [MHz]	FH[MHz]	Limit[MHz]	Verdict
NTNV	11A	Ant1	5745	5736.44	5753.52	5725 to 5850	PASS
NTNV	11A	Ant1	5785	5776.24	5793.72	5725 to 5850	PASS
NTNV	11A	Ant1	5825	5816.24	5833.68	5725 to 5850	PASS
NTNV	11N20SISO	Ant1	5745	5735.84	5754.08	5725 to 5850	PASS
NTNV	11N20SISO	Ant1	5785	5775.88	5794.12	5725 to 5850	PASS
NTNV	11N20SISO	Ant1	5825	5815.84	5834.16	5725 to 5850	PASS
NTNV	11N40SISO	Ant1	5755	5736.68	5773.32	5725 to 5850	PASS
NTNV	11N40SISO	Ant1	5795	5776.68	5813.32	5725 to 5850	PASS
NTNV	11AC20SISO	Ant1	5745	5735.84	5754.16	5725 to 5850	PASS
NTNV	11AC20SISO	Ant1	5785	5775.84	5794.12	5725 to 5850	PASS
NTNV	11AC20SISO	Ant1	5825	5815.84	5834.16	5725 to 5850	PASS
NTNV	11AC40SISO	Ant1	5755	5736.68	5773.32	5725 to 5850	PASS
NTNV	11AC40SISO	Ant1	5795	5776.68	5813.32	5725 to 5850	PASS
NTNV	11AC80SISO	Ant1	5775	5736.76	5813.24	5725 to 5850	PASS

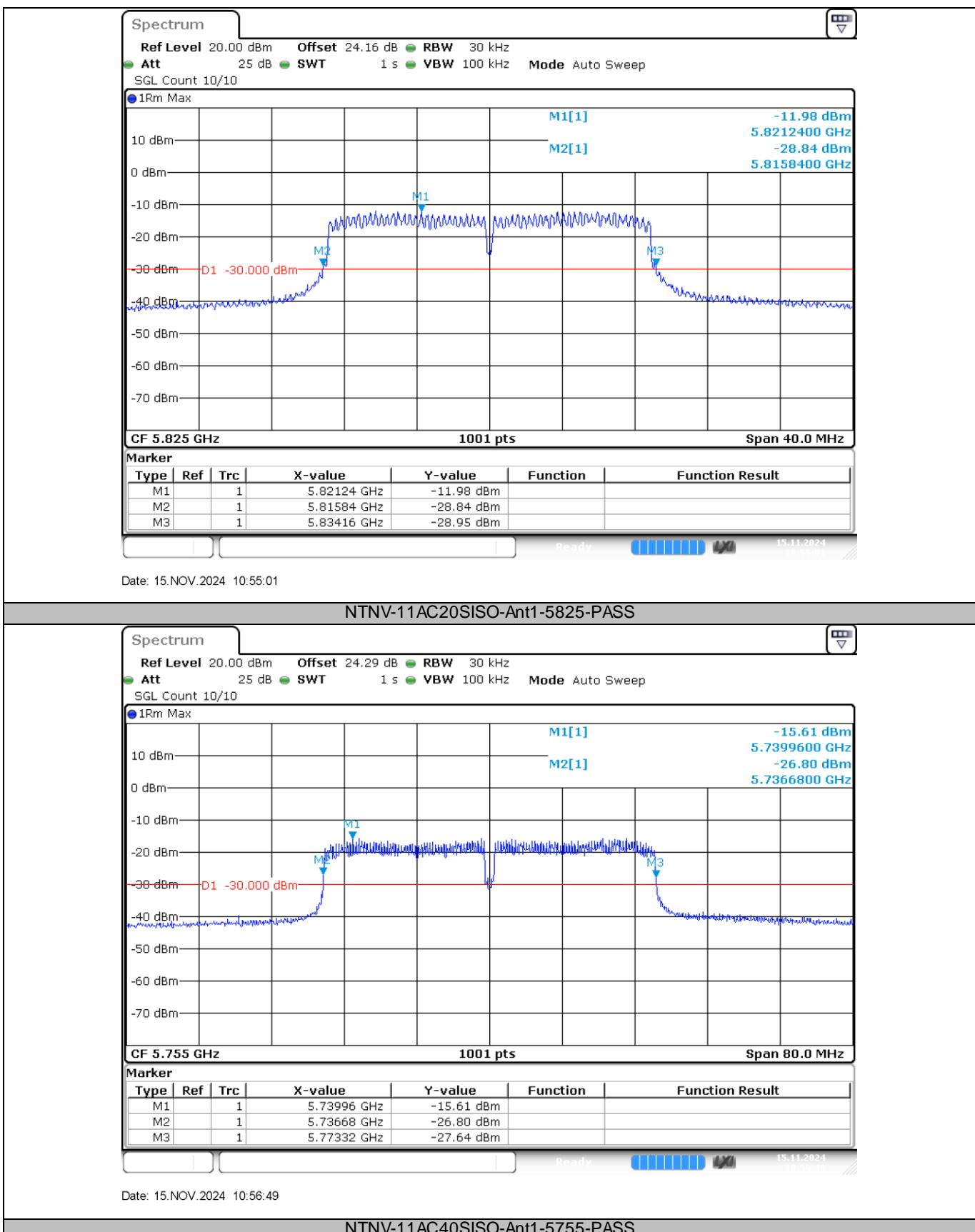


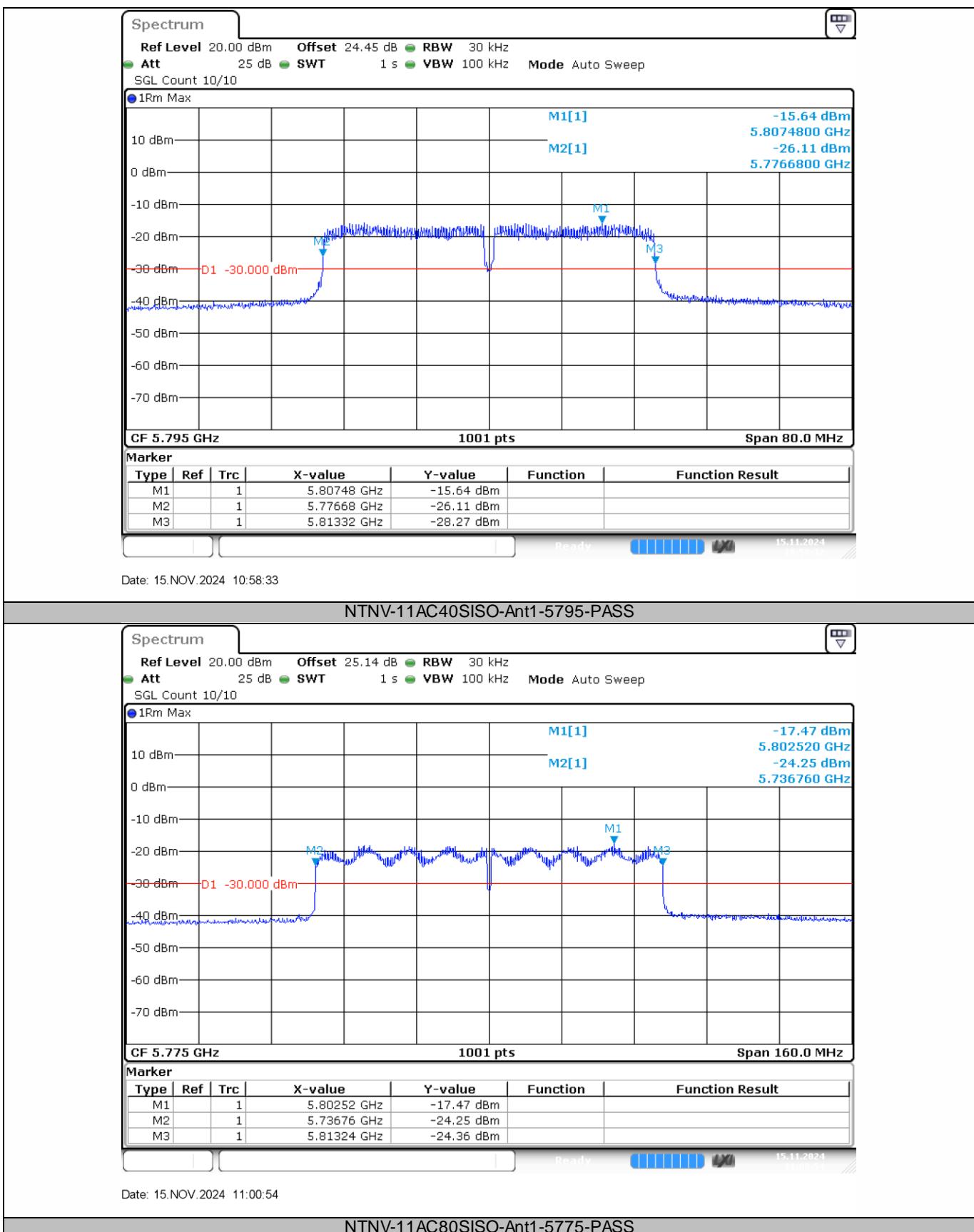












8.3 UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

8.3.1 Applicable standard

ETSI EN 300 440 clause 4.2.4

8.3.2 Conformance Limit

Frequency Range	Maximum power	bandwidth
30 MHz to 47 MHz	-36dBm	100kHz
47 MHz to 74 MHz	-54dBm	100kHz
74 MHz to 87.5 MHz	-36dBm	100kHz
87.5MHz to108 MHz	-54dBm	100kHz
108 MHz to174MHz	-36dBm	100kHz
174MHz to 230MHz	-54dBm	100kHz
230 MHz to 470 MHz	-36dBm	100kHz
470 MHz to 862 MHz	-54dBm	100kHz
862 MHz to1 GHz	-36dBm	100kHz
1GHz to12.75 GHz	-30dBm	1MHz

8.3.3 Test Configuration

The measurements for emissions in the spurious domain shall only be performed at normal test conditions.

The level of spurious emissions shall be measured as either:

- a)
- i) their power level in a specified load (conducted emission); and
- ii) their effective radiated power when radiated by the cabinet and structure of the equipment (cabinet radiation); or
- b) their effective radiated power when radiated by the cabinet and the integral or dedicated antenna, in the case of equipment fitted with such an antenna and no permanent RF connector.

8.3.4 Test Procedure

1. Please refer to ETSI EN 300 440 (V2.2.1) clause 5 for the test conditions.
2. Please refer to ETSI EN 300 440 (V2.2.1) clause 4.2.4.3 for the measurement methods.

■ Conducted spurious emission

This method of measurement applies to transmitters having a permanent antenna connector.

Additional requirements for equipment employing FHSS modulation are given in clause 4.2.4.3.4.

- a) The transmitter shall be connected to a measuring receiver through a test load, $50\ \Omega$ power attenuator, and if necessary, an appropriate filter to avoid overload of the measuring receiver. The bandwidth of the measuring receiver shall be adjusted until the sensitivity of the measuring receiver is at least 6 dB below the spurious emission limit given in table 3, see clause 4.2.4.4. This bandwidth shall be recorded in the test report.

For the measurement of spurious emissions below the second harmonic of the carrier frequency, the filter used shall be a high "Q" (notch) filter centred on the transmitter carrier frequency, which attenuates this signal by at least 30 dB.

For the measurement of spurious emissions at and above the second harmonic of the carrier frequency

the filter used shall be a high pass filter with a stop band rejection exceeding 40 dB. The cut-off frequency of the high pass filter shall be approximately 1,5 times the transmitter carrier frequency.

Precautions may be required to ensure that the test load does not generate or that the high pass filter does not attenuate, the harmonics of the carrier.

b) The transmitter shall be unmodulated and operating at the maximum limit of its specified power range. If modulation cannot be inhibited then the test shall be carried out with modulation (see clause 5.8.1) and this fact shall be recorded in the test report.

c) For carrier frequencies in the range 1 GHz to 20 GHz the frequency of the measuring receiver shall be adjusted over the frequency range 25 MHz to 10 times the carrier frequency, not exceeding 40 GHz. For carrier frequencies above 20 GHz the measuring receiver shall be tuned over the range 25 MHz up to twice the carrier frequency, not exceeding 66 GHz. The frequency and level of every spurious emission found shall be noted.

The emissions within the channel occupied by the transmitter carrier and, for channelized systems its adjacent channels, shall not be recorded.

d) If the measuring receiver has not been calibrated in terms of power level at the transmitter output, the level of any detected components shall be determined by replacing the transmitter by the signal generator and adjusting it to reproduce the frequency and level of every spurious emission noted in step c). The absolute power level of each of the emissions shall be noted.

e) The frequency and level of each spurious emission measured and the bandwidth of the measuring receiver shall be recorded in the test report.

f) If a user accessible power adjustment is provided then the tests in steps c) to e) shall be repeated at the lowest power setting available.

g) The measurement in steps c) to f) shall be repeated with the transmitter in the standby condition if this option is available.

■ Method of measurement - cabinet spurious radiation

This method of measurement applies to transmitters having a permanent antenna connector. For equipment without a permanent antenna connector see clause 4.2.4.3.3.

Additional requirements for equipment employing FHSS modulation are given in clause 4.2.4.3.4.

a) A test site selected from annex B which fulfils the requirements of the specified frequency range of this measurement shall be used. The test antenna shall be oriented initially for vertical polarization and connected to a measuring receiver. The bandwidth of the measuring receiver shall be adjusted until the sensitivity of the measuring receiver, after allowing for the coupling loss, is at least 6 dB below the spurious emission limit given in table 3, see clause 4.2.4.4. This bandwidth shall be recorded in the test report.

The transmitter under test shall be placed on the support in its standard position, connected to an artificial antenna (see clause 5.8.2) and switched on without modulation. If modulation cannot be inhibited then the test shall be carried out with modulation, (see clause 5.8.1), and this fact shall be recorded in the test report.

b) For carrier frequencies in the range 1 GHz to 20 GHz the frequency of the measuring receiver shall be adjusted over the frequency range 25 MHz to 10 times the carrier frequency, not exceeding 40 GHz. For carrier frequencies above 20 GHz the measuring receiver shall be tuned over the range 25 MHz up to twice the carrier frequency, not exceeding 66 GHz, except for the channel on which the transmitter is intended to operate and for channelized systems, its adjacent channels. The frequency of each spurious emission detected shall be noted. If the test site is disturbed by interference coming from outside the site, this qualitative search may be performed in a screened room, with a reduced distance between the transmitter and the test antenna.

c) At each frequency at which an emission has been detected, the measuring receiver shall be tuned and the test antenna shall be raised or lowered through the specified height range until the maximum signal level is detected on the measuring receiver.

d) The transmitter shall be rotated through 360° about a vertical axis, to maximize the received signal.

e) The test antenna shall be raised or lowered again through the specified height range until a maximum is obtained. This level shall be noted.

f) The substitution antenna (see clause B.2.3) shall replace the transmitter antenna in the same position and in vertical polarization. It shall be connected to the signal generator.

g) At each frequency at which an emission has been detected, the signal generator, substitution antenna, and measuring receiver shall be tuned. The test antenna shall be raised or lowered through the specified height range until the maximum signal level is detected on the measuring receiver. The level of the signal generator giving the same signal level on the measuring receiver as in item e) shall be noted. After

corrections due to the gain of the substitution antenna and the cable loss between the signal generator and the substitution antenna, is the radiated spurious emission at this frequency.

- h) The frequency and level of each spurious emission measured and the bandwidth of the measuring receiver shall be recorded in the test report.
- i) Steps c) to h) shall be repeated with the test antenna oriented in horizontal polarization.
- j) If a user accessible power adjustment is provided then the tests in steps c) to h) shall be repeated at the lowest power setting available.
- k) Steps c) to i) shall be repeated with the transmitter in the standby condition if this option is available.

■ Method of measurement - radiated spurious emission

This method of measurement applies to transmitters having an integral antenna.

Additional requirements for equipment employing FHSS modulation are given in clause 4.2.4.3.4.

- a) A test site selected from annex B which fulfils the requirements of the specified frequency range of this measurement shall be used. The test antenna shall be oriented initially for vertical polarization and connected to a measuring receiver, through a suitable filter to avoid overloading of the measuring receiver if required.

The bandwidth of the measuring receiver shall be adjusted until the sensitivity of the measuring receiver, after allowing for the coupling loss, is at least 6 dB below the spurious emission limit given in table 3, see clause 4.2.4.4. This bandwidth shall be recorded in the test report.

For the measurement of spurious emissions below the second harmonic of the carrier frequency the optional filter used shall be a high "Q" (notch) filter centred on the transmitter carrier frequency and attenuating this signal by at least 30 dB.

For the measurement of spurious emissions at and above the second harmonic of the carrier frequency the optional filter used shall be a high pass filter with a stop band rejection exceeding 40 dB. The cut-off frequency of the high pass filter shall be approximately 1,5 times the transmitter carrier frequency.

The transmitter under test shall be placed on the support in its standard position and shall be switched on without modulation. If modulation cannot be inhibited then the test shall be carried out with modulation (see clause 6.1) and this fact shall be recorded in the test report.

- b) The same method of measurement as steps b) and k) of clause 4.2.4.3.2 shall be used.

8.3.5 Test Results

■ Radiation Spurious Emission

All the modulation modes were tested, the data of the worst mode are described in the table.

Emission in the Spurious Domain below 1GHz:

Operation Mode: <input checked="" type="checkbox"/> 802.11a					
Operation frequency:	<input checked="" type="checkbox"/> 5745MHz	Temperature: 25°C			
Humidity:	60 % RH	Tested by: CZF			
Frequency (MHz)	Antenna Polarization	Emission level (dBm)	Limit (dBm)	Margin (dB)	Verdict
26.3653	H	-69.48	-36.00	33.48	PASS
238.1776	H	-75.37	-36.00	39.37	PASS
422.8796	H	-67.95	-36.00	31.95	PASS
648.1496	H	-63.54	-54.00	9.54	PASS
762.0524	H	-68.64	-54.00	14.64	PASS
980.4961	H	-67.51	-36.00	31.51	PASS
54.0608	V	-64.17	-54.00	10.17	PASS
336.0872	V	-73.75	-36.00	37.75	PASS
420.5391	V	-60.20	-36.00	24.20	PASS
648.1496	V	-62.63	-54.00	8.63	PASS
720.119	V	-67.10	-54.00	13.10	PASS
878.1006	V	-67.71	-36.00	31.71	PASS

Emission in the Spurious Domain above 1GHz:

Operation Mode: <input checked="" type="checkbox"/> 802.11a					
Operation frequency:	<input checked="" type="checkbox"/> 5745MHz	Temperature: 25°C			
Humidity:	60 % RH	Tested by: CZF			
Frequency (MHz)	Antenna Polarization	Emission level (dBm)	Limit (dBm)	Margin (dB)	Verdict
3764.753	H	-46.37	-30.00	16.37	PASS
6396.879	H	-43.59	-30.00	13.59	PASS
8124.424	H	-36.52	-30.00	6.52	PASS
11348.26	H	-37.00	-30.00	7.00	PASS
14891.77	H	-36.80	-30.00	6.80	PASS
17146.42	H	-36.43	-30.00	6.43	PASS
3781.756	V	-46.49	-30.00	16.49	PASS
6413.882	V	-43.70	-30.00	13.70	PASS
9443.888	V	-37.04	-30.00	7.04	PASS
11474.09	V	-36.17	-30.00	6.17	PASS
14616.32	V	-36.96	-30.00	6.96	PASS
16758.75	V	-36.49	-30.00	6.49	PASS

9. RECEIVER REQUIREMENTS

9.1 RECEIVER CATEGORY

Applicable	Receiver category	Relevant receiver clauses	Risk assessment of receiver performance
<input type="checkbox"/>	1	4.3.3, 4.3.4 and 4.3.5	Highly reliable SRD communication media; e.g. Serving human life inherent systems (may result in a physical risk to a person).
<input type="checkbox"/>	2	4.3.4 and 4.3.5	Medium reliability SRD communication media e.g. causing inconvenience to persons, which cannot simply be overcome by other means.
<input checked="" type="checkbox"/>	3	4.3.4 and 4.3.5	Standard reliability SRD communication media and radiodetermination devices. E.g. Inconvenience to persons, which can simply be overcome by other means (e.g. manual).

9.2 BLOCKING OR DESENSITIZATION

9.2.1 Applicable Standard

ETSI EN 300 440 Subclasses 4.3.4

9.2.2 Conformance Limit

The blocking level, for any frequency within the specified ranges, shall not be less than the values given in table 6, except at frequencies on which spurious responses are found.

Table 6: Limits for blocking or desensitization

Receiver category	Limit
1	-30 dBm + k
2	-45 dBm + k
3	-60 dBm + k

The correction factor, k, is as follows:

$$k = -20 \log f - 10 \log BW$$

Where:

- f is the frequency in GHz;
- BW is the occupied bandwidth in MHz.

The factor k is limited within the following:

- $-40 \text{ dB} < k < 0 \text{ dB}$.

The measured blocking level shall be stated in the test report.

9.2.3 Methods of measurement

Two signal generators A and B shall be connected to the receiver via a combining network to the receiver, either:

- a) via a test fixture or a test antenna to the receiver integrated, dedicated or test antenna; or
- b) directly to the receiver permanent or temporary antenna connector.

The method of coupling to the receiver shall be stated in the test report.

Signal generator A shall be at the nominal frequency of the receiver, with normal modulation of the wanted signal. Signal generator B shall be unmodulated and shall be adjusted to a test frequency at approximately 10 times, 20 times and 50 times of the receive channel bandwidth above upper band edge of the receive channel.

Initially signal generator B shall be switched off and using signal generator A the level which still gives sufficient response shall be established. The output level of generator A shall then be increased by 3 dB.

Signal generator B is then switched on and adjusted until the wanted criteria are met. This level shall be recorded.

The measurement shall be repeated with the test frequency for signal generator B at approximately 10 times, 20 times and 50 times of the receive channel bandwidth below the lower band edge of the receive channel.

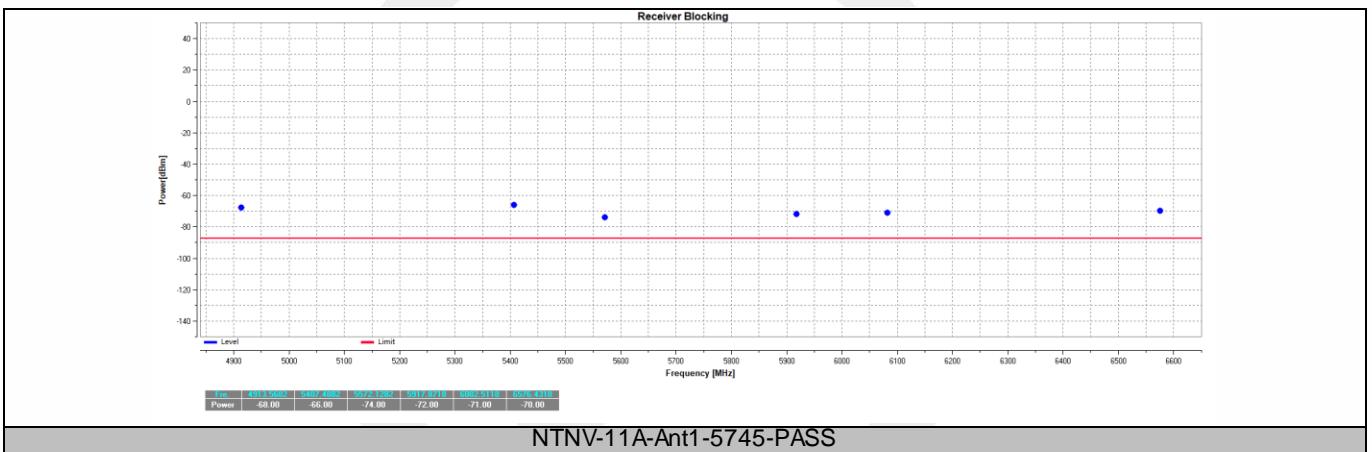
The blocking or desensitization shall be recorded as the level in dBm of lowest level of the unwanted signal (generator B).

For tagging systems (e.g. RF identification, anti-theft, access control, location and similar systems) signal generator A may be replaced by a physical tag positioned at 70 % of the measured system range in metres. In this case, the blocking or desensitization shall be recorded as the ratio in dB of lowest level of the unwanted signal (generator B) resulting in a non-read of the tag. to the declared sensitivity of the receiver +3 dB.

9.2.4 Test Results

Receiver category	Category 1		
Temperature:	25°C		
Humidity:	45% RH	P _{min} :	-84dBm
Tested by:	XXH	Operation frequency:	5745 MHz

TestMode	Antenna	Frequency[MHz]	Wanted SignalLevel [dBm]	Freq. [MHz]	Freq. [MHz]	Result [dBm]	Limit [dBm]	Verdict
11A	Ant1	5745	-84.00	4913.5682	-50	-68.00	-87.35	PASS
11A	Ant1	5745	-84.00	5407.4882	-20	-66.00	-87.35	PASS
11A	Ant1	5745	-84.00	5572.1282	-10	-74.00	-87.35	PASS
11A	Ant1	5745	-84.00	5917.8718	10	-72.00	-87.35	PASS
11A	Ant1	5745	-84.00	6082.5118	20	-71.00	-87.35	PASS
11A	Ant1	5745	-84.00	6576.4318	50	-70.00	-87.35	PASS



9.3 SPURIOUS RADIATIONS

9.3.1 Applicable standard

ETSI EN 300 440 clause 4.3.5

9.3.2 Conformance Limit

Frequency Range	Maximum Power	Measurement Width
25 MHz to 1 GHz	-57 dBm	100kHz
1 GHz to 12.75 GHz	-47 dBm	1MHz

9.3.3 Test Configuration

The measurements for spurious radiations shall only be performed at normal test conditions.

The level of spurious radiations shall be measured by either:

- a) their power level in a specified load (conducted spurious emission) and their effective radiated power when radiated by the cabinet and structure of the equipment (cabinet radiation); or
- b) their effective radiated power when radiated by the cabinet and the integral or dedicated antenna, in the case of portable equipment fitted with such an antenna and no permanent RF connector.

9.3.4 Test Procedure

1. Please refer to ETSI EN 300 440 (V2.2.1) clause 5 for the test conditions.
2. Please refer to ETSI EN 300 440 (V2.2.1) clause 4.3.5.3 for the measurement methods.

■ General Requirements

For measurements above 1 000 MHz the peak value shall be measured using a spectrum analyser. The "max hold" function of a spectrum analyser shall be used. For measurements up to 1 000 MHz the quasi-peak detector set in accordance with the specification of CISPR 16 [1], [2] and [3] shall be used.

■ Method of measurement conducted spurious components

This method of measurement applies to receivers having a permanent antenna connector.

A test load, 50 Ω power attenuator, may be used to protect the measuring receiver (see clause 6.5) against damage when testing a receiver combined in one unit with a transmitter.

The measuring receiver used shall have sufficient dynamic range and sensitivity to achieve the required measurement accuracy at the specified limit. The bandwidth of the measuring receiver shall be adjusted until the sensitivity of the measuring receiver is at least 6 dB below the spurious emission limit given in clause 4.3.5.4. This bandwidth shall be recorded in the test report:

- a) The receiver input terminals shall be connected to a measuring receiver having an input impedance of 50 Ω and the receiver is switched on.
- b) For carrier frequencies in the range 1 GHz to 20 GHz the frequency of the measuring receiver shall be adjusted over the frequency range 25 MHz to 10 times the carrier frequency, not exceeding 40 GHz. For carrier frequencies above 20 GHz the measuring receiver shall be tuned over the range 25 MHz up to twice the carrier frequency not exceeding 66 GHz. The frequency and the absolute power level of each of the spurious components found shall be noted.
- c) If the detecting device is not calibrated in terms of power input, the level of any detected components shall be determined by replacing the receiver by the signal generator and adjusting it to reproduce the frequency and level of every spurious component noted in step b). The absolute power level of each spurious component shall be noted.
- d) The frequency and level of each spurious emission measured and the bandwidth of the measuring receiver shall be recorded in the test report.

■ Method of measurement cabinet radiation

This method of measurement applies to receivers having a permanent antenna connector.

- a) A test site selected from annex B which fulfils the requirements of the specified frequency range of this

measurement shall be used. The test antenna shall be oriented initially for vertical polarization and connected to a measuring receiver. The bandwidth of the measuring receiver shall be adjusted until the sensitivity of the measuring receiver is at least 6 dB below the spurious emission limit given in clause 4.3.5.4. This bandwidth shall be recorded in the test report.

The receiver under test shall be placed on the support in its standard position and connected to an artificial antenna, see clause 5.8.2.

- b) For carrier frequencies in the range 1 GHz to 20 GHz the frequency of the measuring receiver shall be adjusted over the frequency range 25 MHz to 10 times the carrier frequency, not exceeding 40 GHz. For carrier frequencies above 20 GHz the measuring receiver shall be tuned over the range 25 MHz up to twice the carrier frequency not exceeding 66 GHz. The frequency of each spurious component shall be noted. If the test site is disturbed by radiation coming from outside the site, this qualitative search may be performed in a screened room with reduced distance between the transmitter and the test antenna.
- c) At each frequency at which a component has been detected, the measuring receiver shall be tuned and the test antenna shall be raised or lowered through the specified height range until the maximum signal level is detected on the measuring receiver.
- d) The receiver shall be rotated up to 360° about a vertical axis, to maximize the received signal.
- e) The test antenna shall be raised or lowered again through the specified height range until a maximum is obtained. This level shall be noted.
- f) The substitution antenna (see clause B.3.2) shall replace the receiver antenna in the same position and in vertical polarization. It shall be connected to the signal generator.
- g) At each frequency at which a component has been detected, the signal generator, substitution antenna and measuring receiver shall be tuned. The test antenna shall be raised or lowered through the specified height range until the maximum signal level is detected on the measuring receiver. The level of the signal generator giving the same signal level on the measuring receiver as in step e) shall be noted. This level, after correction due to the gain of the substitution antenna and the cable loss, is the radiated spurious component at this frequency.
- h) The frequency and level of each spurious emission measured and the bandwidth of the measuring receiver shall be recorded in the test report.
- i) Measurements b) to h) shall be repeated with the test antenna oriented in horizontal polarization.

■ Method of measurement radiated spurious components

This method of measurement applies to receivers having an integral antenna.

- a) A test site selected from annex B which fulfils the requirements of the specified frequency range of this measurement shall be used. The test antenna shall be oriented initially for vertical polarization and connected to a measuring receiver. The bandwidth of the measuring receiver shall be adjusted until the sensitivity of the measuring receiver is at least 6 dB below the spurious emission limit given in clause 4.3.5.4. This bandwidth shall be recorded in the test report.

The receiver under test shall be placed on the support in its standard position.

- b) The same method of measurement as items b) to i) of clause 4.3.5.3.2 shall apply.

9.3.5 Test Results

■ Radiation Spurious Emission

All the modulation modes were tested, the data of the worst mode are described in the table.

Receive in the Spurious Domain below 1GHz:

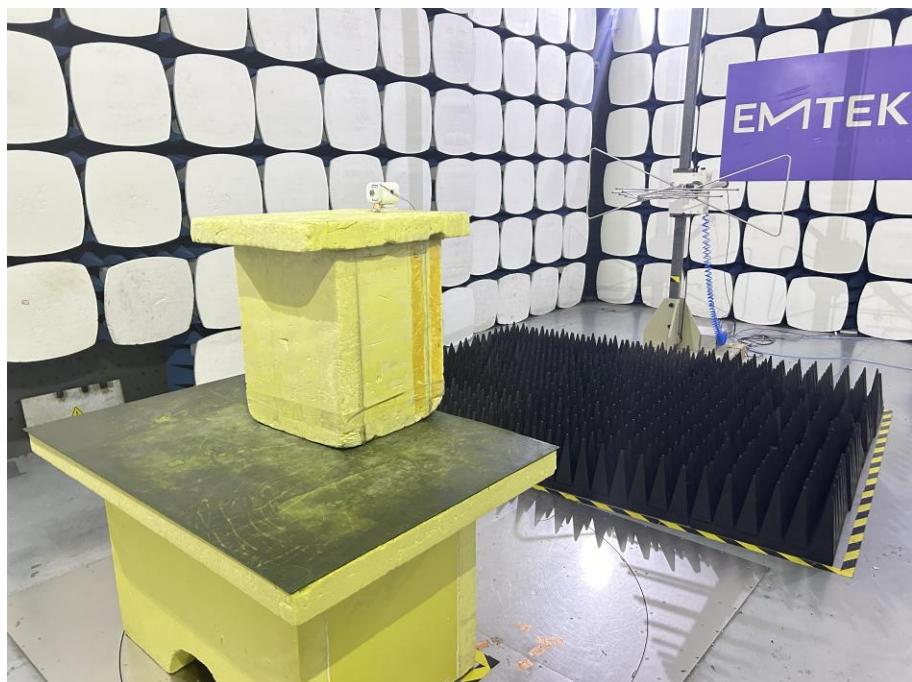
Operation Mode: <input checked="" type="checkbox"/> 802.11a					
Operation frequency:	<input checked="" type="checkbox"/> 5745MHz	Temperature: 25°C			
Humidity:	60 % RH	Tested by: CZF			
Frequency (MHz)	Antenna Polarization	Emission level (dBm)	Limit (dBm)	Margin (dB)	Verdict
26.6088	H	-70.79	-57.00	13.79	PASS
188.9544	H	-74.95	-57.00	17.95	PASS
418.9197	H	-67.76	-57.00	10.76	PASS
648.0074	H	-64.14	-57.00	7.14	PASS
756.1891	H	-69.58	-57.00	12.58	PASS
992.6384	H	-67.64	-57.00	10.64	PASS
54.154	V	-64.06	-57.00	7.06	PASS
422.2349	V	-60.42	-57.00	3.42	PASS
487.4656	V	-61.41	-57.00	4.41	PASS
648.0074	V	-63.52	-57.00	6.52	PASS
720.0148	V	-67.02	-57.00	10.02	PASS
932.6729	V	-68.69	-57.00	11.69	PASS

Receive in the Spurious Domain above 1GHz:

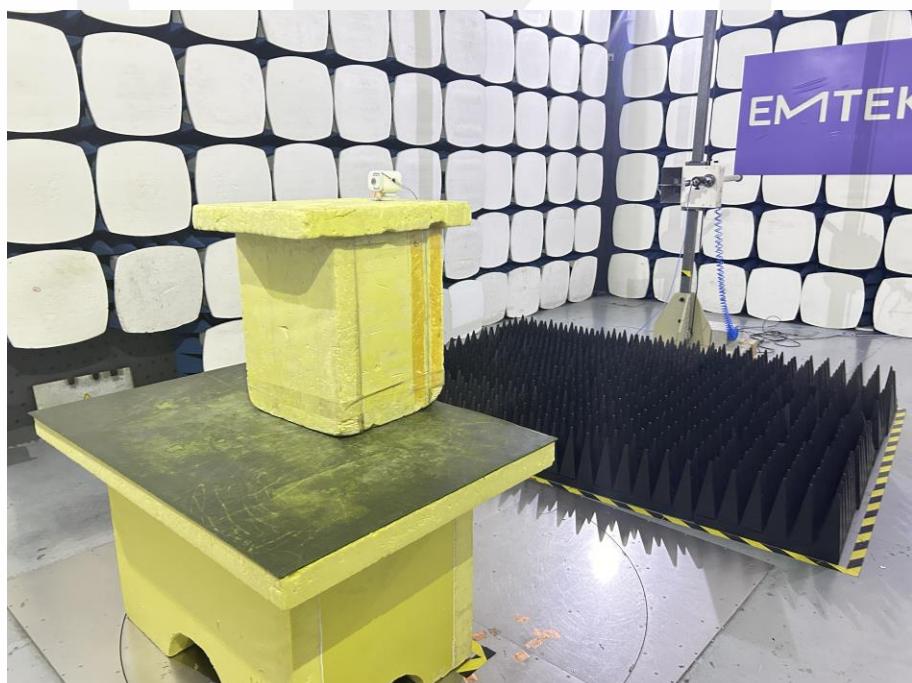
Operation Mode: <input checked="" type="checkbox"/> 802.11a					
Operation frequency:	<input checked="" type="checkbox"/> 5745MHz	Temperature: 25°C			
Humidity:	60 % RH	Tested by: CZF			
Frequency (MHz)	Antenna Polarization	Emission level (dBm)	Limit (dBm)	Margin (dB)	Verdict
3790.689	H	-63.03	-47.00	16.03	PASS
6586.479	H	-60.57	-47.00	13.57	PASS
9259.863	H	-53.87	-47.00	6.87	PASS
11051.75	H	-53.65	-47.00	6.65	PASS
14068.55	H	-53.83	-47.00	6.83	PASS
17064.10	H	-53.61	-47.00	6.61	PASS
3646.182	V	-63.50	-47.00	16.50	PASS
6574.578	V	-59.76	-47.00	12.76	PASS
9239.462	V	-54.05	-47.00	7.05	PASS
10852.84	V	-53.68	-47.00	6.68	PASS
12371.01	V	-53.80	-47.00	6.80	PASS
16786.98	V	-53.74	-47.00	6.74	PASS

10. APPENDIX PHOTOGRAPHS OF TEST SETUP

Spurious Emission Test Setup (Below 1GHz)



Spurious Emission Test Setup (Above 1GHz)



--- End of Report ---

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